EXPLANATION OF PLATE II.

Figs. 1, 2. Youngest colony of *Montipora* found, 3·5 millim. in long diameter: *pp*, the largest and tallest calicle, presumably that of the parent polyp of the colony. The saucer-shaped epitheca has been turned in, and the outward growth at *a* has been hindered; hence the initial symmetry has been destroyed, the young stock having expanded chiefly in the direction of *b*.

Fig. 3. Diagrams showing the building up of the Montiporan corallum. The budding of the thick-walled polyps is shown by lines: the originally laminate septa and costæ lying in the plane of the paper are covered with curved dotted lines, to represent the ordinary appearance of the basal streaming layer in sections at right angles to the growing edge. The tissue which secondarily thickens the corallum is:—

(*a*) A reticulum which does not rise above the level of the calicles.

(*b*) A reticulum which surges up to form spongy ramparts or papillæ.

(*c*) A reticulum of which the more vertical elements are straightened and thickened and project above the surface as tubercles. In these figures the streaming layer has been drawn very thick for the sake of clearness. In reality the relative thicknesses of the layers should be reversed, the streaming layer being, in many cases at least, the thinner.

Fig. 4. Diagrams to show the different specializations in form and method of budding of the parent polyp, which will explain the leading characters of the four chief Madreporidan genera:—(a) *Madrepora*, (b) *Turbinaria*, (c) *Astræopora*, (d) *Montipora*.

Fig. 5. A protuberant calicle of *Anacropora gracilis* (× ca. 20), showing the laminate septa and the edges of the costæ running down the outer walls.

XII.—*Contributions from the New Mexico Biological Station.* —VI. *The New Mexico Bees of the Genus* Heriades, *and a new* Halictus. By T. D. A. Cockerell.

The bees herein described all fall under *Heriades* in the broad sense, but they present considerable differences, which might be considered of subgeneric or even generic value.

A. *Legs partly red.*

a. Smaller species, the red confined to the front legs.

Heriades asteris, sp. n.

♂. Length about 5 millim.

Black, with the anterior femora in front and within and the broadened anterior tibiæ behind ferruginous. The whole insect very coarsely sculptured, the punctures of the vertex and mesothorax extremely large, producing a subcancellate

effect, just as in *H. carinata*. Head rounded, not particularly swollen behind the eyes; cheeks beneath and anterior margin of clypeus each with a large and dense brush of white hairs; anterior margins of eyes, up to a distance above the level of the antennæ equal to the length of the scape, bordered by a conspicuous white hair-band; vertex and the rest of the face almost free from hairs, but some scattered pubescence above the level of the antennæ; antennæ long, flagellum brownish beneath, its first two joints about equal, the third somewhat longer; clypeus much more finely punctured than the face above. In another specimen the clypeus is covered with white hair and the face is more hairy. Thorax very little hairy, the white pubescence most noticeable about tubercles and along the hind margin of scutellum, but dense on the ventral surface between the legs. Tegulæ shining piceous. Wings rather short, rather dusky, especially along the costa beyond the stigma, beautifully iridescent; nervures and stigma piceous, stigma moderately well developed, first recurrent nervure reaching second submarginal cell only just beyond the origin of the first transverse cubital. Abdomen with distinct but narrow white hair-bands, its dorsal surface with very large punctures. It does not end in four projections, but is similar in general structure to that of *H. carinata*.

Hab. Las Cruces, N. M., on *Aster spinosus*, August (Ckll. 4626), and on *Solidago canadensis*, Sept. 3 (Ckll. 4748).

b. Larger species, the red practically confined to the four hindmost legs.

Heriades bigeloviæ, sp. n.

♂. Length about 5½ millim.

More bulky than the last, the head quite large, though not notably extended behind the eyes. Black, with the middle and hind femora and the hind tibiæ and tarsi bright ferruginous. Pubescence white, tolerably abundant, quite covering the face up to a little below the middle ocellus, dense on the cheeks beneath and along margins of mesothorax, scutellum, metathorax, and pleura; the disk of the meso- and metathorax nude, not so the pleura; abdominal segments with very distinct apical hair-bands, snow-white, the first much broadened at the side; legs more or less white-hairy. Punctuation of vertex, thoracic dorsum, and abdomen strong and tolerably close, but not nearly so large or coarse as in the *carinata* group. Basal enclosure of metathorax smooth, shining, impunctate. Tegulæ testaceous, pubescent. Wings perfectly hyaline, nervures and stigma piceous. Stigma

very little developed, first recurrent nervure joining second submarginal cell at a distance from the origin of the first transverso-cubital nervure greater than half the length of the latter. Abdomen suboval, without a subbasal ventral projection; apex with four approximately equidistant teeth, the median ones not broadened.

♀. Similar to the male, with a white ventral scopa. Ventral base of abdomen with a short tooth-like projection. Antennæ shorter.

Hab. Las Cruces, N. M., on *Bigelovia Wrightii*, Sept. 23, a male. Also a male, June 16, on *Aster spinosus* (Ckll. 3036). A female was taken as early as April 27 on the occasion of a meeting of the Agricultural College Field Club.

This species belongs to an entirely different group from *asteris* &c.

B. *Legs entirely black.*

a. First recurrent nervure uniting with first transverso-cubital.

Heriades crucifera, sp. n.

♂. Length about or slightly over 6 millim.

In appearance, structure and punctuation, &c. this is like the male of *carinata*, but it differs as follows:—

crucifera ♂.	*carinata* ♂.
First recurrent nervure uniting with the first transverso-cubital.	First recurrent nervure not so uniting.
First ventral segment of abdomen shovel-shaped, viewed laterally not unlike the head of the snake *Heterodon nasicus* upside down.	First ventral segment of abdomen produced into a large blunt tooth, erect and a little excavated posteriorly.
Face a little narrower; clypeus only fringed with white hair.	Face a little broader; clypeus covered with white hair.

Hab. Santa Fé, N. M., July 18 (Ckll. 1546).

b. First recurrent nervure reaching second submarginal cell at a point distant from the origin of the first transverso-cubital less than half the length of the latter. Thorax usually very coarsely sculptured. Stigma distinct. Wings smoky at apex.

Heriades carinata, Cresson, 1864.

I have an Illinois specimen from Mr. Robertson, and it agrees with the insect as found in New Mexico. Females are before me from the following places:—(1) Santa Fé, N. M., Aug. 2 and 3, at flowers of *Grindelia squarrosa*, three;

(2) Santa Fé, Aug. 3, one on *Solidago canadensis*; (3) Socorro, N. M., June 29, one on a species of Compositæ; (4) Las Cruces, N. M., Sept. 3, one on *Solidago canadensis*; (5) Las Cruces, June 16, on *Aster spinosus*; (6) Mesilla, N. M., Aug. 15, one on *Solidago canadensis*; (7) Mesilla, Aug. 29, on *Bigelovia Wrightii*; (8) Colorado Springs, Col., middle of July. The specimens from Santa Fé and Colorado Springs seem to average larger than those from the Mesilla Valley. Of the male I have three examples from Ruidoso Creek, collected by Prof. E. O. Wooton, one on *Veronica*, sp., July 1; one on *Erysimum*, at 6600 feet, July 3; one on *Rhus*, at 6600 feet, July 10. It will be noted that the females were all taken on Compositæ, but not so the males. The species apparently does not fly earlier than about the middle of June.

Heriades gracilior, sp. n.

♀. Length 8 millim. or slightly over.

Black; abdomen long and rather slender, with parallel sides. Pubescence dirty white, scanty and inconspicuous on head and thorax, most abundant about tubercles, hind border of scutellum, and round the antennæ. Punctuation strong and moderately dense, but not nearly so coarse or dense as in *carinata*; the shining surface of the mesothorax is plainly evident between the punctures, and still more is that of the abdomen. Head longitudinally broad-oval; clypeus strongly punctured, bulging, with more or less of a central ridge; mandibles very broad, with a conspicuous prominence on the outer side not far from the base; antennæ entirely dark; flagellum slightly inclined to be flattened. Metathorax obliquely truncate, the upper edge of the truncation shining. Tegulæ shining piceous. Wings smoky hyaline, darkest in and just beyond the marginal cell. Venation as in *carinata*, except that the marginal cell is relatively longer and narrower. Legs sparsely hairy. Abdomen with very distinct but very narrow white hair-bands. Ventral scopa white, not very abundant.

Hab. At flowers of *Opuntia* with *H. opuntiæ*, Soledad Cañon, Organ Mountains, N. M., May 22 (*Ckll.*).

A considerably larger insect than *H. carinata*; it is of the same group, though it exhibits a style of punctuation more common in the next group.

c. First recurrent nervure reaching second submarginal cell at a point distant from the origin of the first transverso-cubital more than half the length of the latter. Stigma small or subobsolete. Wings not smoky at apex.

i. Large species, tegulæ dark ferruginous.

Heriades opuntiæ, sp. n.

♀. Length about 10 millim.

Black, with white pubescence. Punctuation throughout strong, but fine and close, yet not close enough to prevent the surface from shining. Pubescence conspicuous only round antennæ, at sides of face, on cheeks beneath, on and above tubercles, on anterior part of mesothorax, along margins of pleura, in a line above the wings, continuous along hind margin of scutellum, along lateral edges of metathorax, on coxæ, femora beneath, tibiæ and tarsi rather thinly in front, and in the abdominal scopa and the five white narrow bands above. All this is white, but the tarsi on the inner side are clothed with orange-rufous hairs. Head very large, subquadrate, seen from in front as large as the lateral view of the thorax, broad behind the eyes, closely punctured on the vertex and cheeks, but with larger much sparser punctures on the shining clypeus. Antennæ short, flagellum faintly brownish towards the end. Mandibles very broad, the long oblique inner edge ornamented with appressed ferruginous hairs, and presenting a tooth about its middle. There is no sort of prominence on the outer side. Eyes bicoloured, black in front, sage-green behind. Tegulæ shining dark ferruginous. Wings clear, nervures and stigma black, stigma extremely small. The anterior margin of the clypeus is perfectly straight, and beneath it are some very bright orange-ferruginous hairs. The base of the metathorax is smooth and shining. The tibial spurs, which are pale yellowish brown in *H. gracilior*, are so only on the front legs of *opuntiæ*, on the others being black. The four anterior tibiæ in *gracilior* come to a decided point at the end on the outer side at an angle of perhaps 50°; but in *opuntiæ* they exhibit at the same place a short but slender spine, slightly curved upwards. The hind tibiæ are slightly nodulose on the outer side in *gracilior*, not so in *opuntiæ*.

Hab. At flowers of *Opuntia*, Soledad Cañon, N. M., May 22 (*Ckll.*). At one time I took this for *H. rotundiceps*, Cresson; but on comparing it closely with Cresson's description, it is evidently distinct.

ii. Smaller, tegulæ black or piceous.

Heriades prosopidis, sp. n.

♀. Long. 5 millim.

Black, of the usual form; abdomen with narrow white hair-bands. Head large, subquadrate; vertex shining, with large extremely close punctures; face somewhat hairy, sides of face covered with white plumose hairs, forming very conspicuous patches; clypeus punctured, more or less clothed with silvery hairs; mandibles dark, grooved without; antennæ short, wholly dark; eyes sage-green, except the anterior two-fifths, which are intense black. Thorax shining, strongly and closely but not confluently punctured; pubescence scanty over most of the surface, but forming patches in front of and above wings and at sides of metathorax, the pleura also being margined with white hairs. Tegulæ shining piceous. Wings iridescent, perfectly hyaline; nervures and stigma black, stigma quite small. Legs black, sparsely hairy, the four hindmost tarsi clothed within with ferruginous hairs. Abdomen rather shiny, strongly and rather closely punctured, with four conspicuous but very narrow white hair-bands. Apical segment thinly clothed above with short silvery hairs. Ventral scopa white. First ventral segment with a thorn-like prominence. Mandibles broad and tridentulate at apex.

Hab. Mesilla, New Mexico, three at flowers of mesquite (*Prosopis*), in company with *Prosopis mesillæ*, *P. asininus*, and *Perdita exclamans*, May 7, 1896.

I have also a single male, taken at Las Cruces, N. M., June 16, on *Aster spinosus* flowers; it is like the female, but somewhat smaller, with a more densely pubescent face, longer antennæ, and the tip of the abdomen exhibits four short teeth. This little species could be taken for *H. variolosa*, Cresson, but the punctures of the third abdominal segment are no larger than those of the second.

Heriades cactorum, sp. n.

♀. Length about 6 millim.

Uniformly larger than *H. prosopidis*, but very similar to it. The pubescence of the face forms two very conspicuous white bands at the sides and is fairly abundant about the antennæ; it does not at all conceal the surface of the clypeus. The punctuation of the pleura is somewhat closer than in *prosopidis*, and the stigma is perhaps rather smaller. The flagellum becomes tinged perceptibly with dark brown. The eyes are

bicoloured, as in *prosopidis*. The second and third segments of the abdomen are punctured alike.

Hab. Santa Fé, N. M., July 10, three at flowers of *Cactus radiosus*, var. *neomexicanus* (Eng.), in Mr. Boyle's garden; they burrowed deeply down among the anthers. One at Colorado Springs, Colorado, middle of July.

This species does not appreciably differ from *H. prosopidis*, at least in the female, except in the characters given above; yet I believe it is certainly a different species. I have a series of each, and the differences are constant; the bees also occur on different kinds of flowers in different life-zones.

Heriades meliloti, sp. n.

♂. Length about 6½ millim.

Stoutly built; head large, seen from in front almost exactly circular; eyes bicoloured green and black, face covered with white hairs; vertex with very sparse silvery hairs, shining, strongly but only moderately densely punctured; antennæ not very long, flagellum only very feebly brown; mandibles deeply bifid at ends, the two teeth sharp, no indication of a third; thorax not densely but quite copiously white-hairy; mesothorax with strong quite close punctures, similar punctures on scutellum not so close; tegulæ shining piceous; nervures and stigma black; wings hyaline; base of metathorax smooth and shining; small joints of tarsi rufescent; abdomen with strong and tolerably close punctures, similar on the second and third segments; the narrow white hair-bands very distinct; apex with four equidistant teeth, of which the two middle are the larger, but are not broadened. Venter with two white hair-bands; subbasal projection not very large, hairy.

Hab. Four in the Mesilla Valley, N. M., near Las Cruces. One was on *Melilotus indica*, on the College Farm, early in May; two were on the College campus, Sept. 10, at the same spot as a lot of *Plenoculus Cockerellii*, Fox *.

H. meliloti differs from the male of *H. prosopidis* at once in its considerably larger size, the much larger head, and relatively shorter antennæ. It is a somewhat larger insect than even the female of *cactorum*, so it is not likely to be its male, especially since it was found in a quite different locality.

The male of *H. osmoides*, Cresson, which I took at Colorado

* The *P. Cockerellii* were flying rapidly over the sand only a few inches above the surface and burrowing in it. I saw two making a great fuss, and found they were struggling for the possession of a small caterpillar.

Springs, Colorado, at the middle of July, is distinguished from *meliloti* by its considerably larger size and the fact that the two middle teeth at the end of the abdomen are considerably broader than long.

I have a single female from Soledad Cañon, in the Organ Mountains, which I think must belong to *meliloti*. It was collected by Prof. C. H. T. Townsend on Aug. 15 on *Melampodium cinereum*, DC. (det. E. O. Wooton); it is extremely like Sta. Fé *cactorum*, but larger, about 6½ millim. long, and has a noticeably larger head and broader face.

Halictus ruidosensis, sp. n.

♀. Length 6 millim.

Head and thorax very dark Prussian green, abdomen and legs black. Head ordinary, face broad; eyes converging above and below, so that the inner orbital margin is noticeably curved; face and front rough from the strong and extremely close punctuation, dark blue-green; except the clypeus and supraclypeal area, which are olive-green with a coppery lustre, the anterior margin of the clypeus broadly black. The punctuation of the lower parts of the face is also much less close than that above, and the clypeus and supraclypeal area are minutely roughened with strong but quite sparse punctures. Mandibles dark rufescent at ends; antennæ wholly very dark brown. Pubescence throughout dirty white, with a faint yellowish tint, sparse on head and thorax, but conspicuous in certain lights, not at all concealing surface of face. Thorax dark blue-green, metathorax perhaps a little bluer than the parts in front of it; mesothorax minutely granular and strongly and quite closely punctured; a distinct median impressed line; with a strong lens in a good light the postscutellum and hind part of scutellum appear quite an olive-green and the metathorax deep blue-black, strongly contrasting; metathorax minutely granular, rather shining, truncate, the distinct crescent-shaped basal area bounded only by a rounded edge; basal portion of enclosure finely rugoseplicate. Tegulæ shining piceous, not punctured. Wings hyaline, iridescent, slightly dusky towards apex; nervures and stigma piceous. Legs black, tibial spurs rufous, hind legs quite densely pubescent. Abdomen moderately broad, brown-black; first segment sparsely and feebly punctured, remaining segments more closely but still feebly punctured; hind margins of segments so narrowly and feebly testaceous that it is not readily noticeable; no hair-bands, but sides of first three segments, and dorsum of hind part of third and all

fourth and fifth pruinose from a fine pubescence, which on the lateral bases of the second and third segments tends to form triangular marks.

♂. Like the female, abdomen narrower.

Hab. Ruidoso Creek, New Mexico; six collected by Prof. E. O. Wooton, viz.:—(1) no. 21, at 6600 feet, July 3, on *Erysimum*; (2) no. 49, a variety with the clypeus and supraclypeal area concolorous with the rest of the face, at 7500 feet, July 6; (3) no. 24, July 3, on *Mimulus luteus*; (4) no. 142, at 6600 feet, July 10, on *Rhus*; (5) no. 171, at 6600 feet, July 10, on *Rhus*; (6) no. 170, also on *Rhus* with the last.

La Tenaja, near Santa Fé, N. M., collected by Miss Myrtle Boyle.

Santa Fé, N. M., seven, as follows:—(1) Ckll. 1141, the only male I have, unfortunately without its head, on alfalfa, Andrews orchard, June 27; (2) Ckll. 3468, on *Linum Lewisii* in garden, July 12; (3) Ckll. 1407, July 10, Boyle coll.; (4) Ckll. 4242, Aug. 5; (5) Ckll. 4055, Aug. 2, on *Clematis ligusticifolia*; (6) Ckll. 4044 and 4046, Aug. 2, on *Solidago canadensis*.

Las Cruces, N. M., March 31, 1896, on *Sisymbrium*.

This is a species of the transition-zone, though a single specimen was taken at Las Cruces, in the Upper Sonoran. Ordinarily it is known especially by the dark nervures and stigma, not at all metallic abdomen, and contrasting colour of the clypeus and supraclypeal area. The stigma may be slightly pallid, a sort of rather dilute sepia, but never honey-yellow; in one example only, apparently conspecific (Wooton's no. 49), did the character of the clypeal coloration fail.

H. ruidosensis is very similar to *H. Ashmeadii*, Rob., from Florida, but the latter will at once be distinguished by the narrower face and the lively reddish-brown colour of the tegulæ; the second submarginal cell in *Ashmeadii* is much narrowed above, but in *ruidosensis* it is very little narrowed.

Mesilla, New Mexico, U.S.A.,
May 9, 1897.

XIII.—*Revision of the Pierine Butterflies of the Genus* Delias. By A. G. Butler, Ph.D. &c., Senior Assistant-Keeper, Zoological Department, British Museum.

As recently as 1893 Ritter von Mitis essayed a revision of this genus in the German 'Iris,' pp. 100–153; he, however, overlooked two or three described forms, and his material evidently was far from rich enough to enable him to form a